Enhancing Preservice Teacher Development: Field Experiences With Gifted Students

Michelle T. Chamberlin and Scott A. Chamberlin
University of Wyoming

During 3 field experience visits, 23 elementary preservice teachers implemented mathematical problem-solving tasks with grade 3–6 gifted students. Researchers investigated what the teachers learned about gifted students regarding student characteristics, mathematical problem-solving tasks, and pedagogy. Each teacher completed a pre- and post-journal, detailing what they expected to occur and then describing what occurred and how their initial expectations were altered. Further, no training was provided regarding gifted students or conceptions of giftedness in previous coursework. Researchers found that teachers broadened their view of giftedness, recognized the need to adapt instruction for gifted students, made efforts to align problem-solving tasks with gifted students' readiness and interests, realized the necessity of knowing students to differentiate instruction, and emphasized student-centered instruction. These results contribute to the promise of having preservice teachers engage in a field experience with gifted students to supplement discussions about gifted education in methods courses.

The fact that gifted education does not hold much prominence in teacher preparation programs is not a revelation (Chamberlin & Moore, 2006). When preservice teachers do receive preparation in gifted education, it often consists of only short discussions in education courses (Chamberlin & Moore, 2006). Such sparse treatment of gifted education is rarely sufficient to prepare teachers to meet the needs of gifted students. Combining classroom discussions and field experiences with gifted students may better prepare preservice teachers to meet gifted students' needs. On this premise, researchers collected data to investigate what preservice teachers learned while implementing a series of mathematical problem-solving tasks with gifted students in grades 3–6. This study builds on existing research

Michelle T. Chamberlin is an assistant professor in the Department of Mathematics at the University of Wyoming. Scott Chamberlin teaches mathematics education courses for elementary preservice teachers and graduate students as well as assessment courses at the University of Wyoming.

Journal for the Education of the Gifted. Vol. 33, No. 3, 2010, pp. 381–416.

that describes the benefits of having preservice teachers work with gifted students and specifically reports on what the preservice teachers learned about gifted students with regard to student characteristics, mathematical problem-solving tasks, and pedagogy.

Training Methods for Preservice Teachers

A recent discussion among gifted educators has been how to improve awareness and instruction of gifted students among beginning teachers. Perhaps one of the principal reasons why beginning and preservice teachers have little to no awareness of gifted education is due to their lack of exposure in training. The problem may be further exacerbated by a lack of placement options. These issues may be the result of little to no attention invested in discussions regarding gifted students during undergraduate coursework or field experience opportunities. This lack of exposure often stems from instructors' lack of knowledge of gifted education as Chamberlin and Moore (2006) explicated. The lack of exposure in teacher training may also be attributed to a social stigma that does not place emphasis on educating the gifted. The lack of interest in gifted education is likely to be attributed to ambivalence among the general population in the United States (Bégin & Gagné, 1994a). As proof of this ambivalence, Bain, Bliss, Choate, and Sager-Brown (2007) reported that 76% of undergraduate preservice teachers felt that gifted students would succeed if left alone in the classroom and 64% felt that gifted programs were elitist rather than egalitarian. In either case, training opportunities appear to be insufficient and ineffective in preparing preservice teachers to meet the needs of gifted students (Moon & Rosselli, 2000; VanTassel-Baska, 2003).

The preservice teachers who are exposed to gifted education often receive only a short unit (e.g., one to two hours) of a discussion in an undergraduate education class (Chamberlin & Moore, 2006). Discussions of gifted education appear to be preferential to no discussion at all, although some report that the qualitative difference in preparation programs has minimal impact (Bangel, Enersen, Capobianco, & Moon, 2006; McCoach & Siegle, 2007). Thus, the minimal impact of class discussions may precipitate the consideration of adding a field experience to preservice teacher preparation.

Reading about gifted education without learning about it experientially is an inadequate way to prepare teachers to deal with gifted students (Westberg, Archambault, Dobyns, & Salvin, 1993). Moreover, a primary predictor of supportive teacher attitudes toward the gifted is contact with gifted students (Bégin & Gagné, 1994a, 1994b). A few studies have found that work with gifted students complemented by coursework in gifted education helps teachers recognize the needs of gifted students as well as respond to those needs in the classroom (Bangel et al., 2006; Feldhusen & Huffman, 1988). In a 1988 study, Feldhusen and Huffman designed, implemented, and evaluated a practicum course for teachers who were practicing, yet new to gifted education. The 209 teachers reported that the practicum teaching and associated observations were effective learning experiences. Feldhusen and Huffman further reported that the observers of the teachers' lessons indicated the teachers achieved a high level of competence in teaching gifted students. Changes in 5 preservice teachers' perceptions of the needs and characteristics of gifted students were examined after participating in a practicum with gifted students and in an associated course on gifted education (Bangel et. al, 2006). They found that the practicum and course provided the preservice teachers with firsthand knowledge and skills to support gifted students in the classroom. Both of these studies point to the promise of teachers working with gifted students to enhance their abilities to meet the needs of gifted students in the classroom.

Despite this research, much remains to be learned. For example, will results similar to those of Feldhusen and Huffman (1988) be found with preservice teachers? Moreover, will results similar to Bangel et al. (2006) be found with more preservice teachers in a different context? In addition, what can be learned about the impact of an experience with gifted students on preservice teachers' perceptions of the characteristics of gifted students, of effective mathematical problem-solving tasks for gifted students, and of effective pedagogy for gifted students? To begin addressing such questions in this study, elementary preservice teachers enrolled in a methods class participated in a field experience with gifted students. Data were collected before the field experience by having preservice teachers predict what the experience would entail and after the field experience by having preservice teachers record what actually transpired. The intent here is

to contribute to the knowledge base on how fieldwork may contribute to the preparation of preservice teachers in gifted education. Due to our interest in the impact on the preservice teachers' perceptions of characteristics of gifted students, mathematical problem-solving tasks, and pedagogy, we review here the literature in these three areas.

Teacher Perceptions of Characteristics of Gifted Students

Teachers' perceptions of students impact their classroom decisions and therefore are of importance in considering how to meet the needs of gifted students. The most alarming perception in gifted education appears to be a stance of apathy: No special efforts are needed to meet the needs of gifted students as they will succeed without interventions given their advanced abilities (Tomlinson, Tomchin, & Callahan, 1994). As stated previously, 76% of 285 undergraduates felt gifted children would excel without special services (Bain et al., 2007). Other researchers have revealed that teachers may not just be apathetic, but also hold hostile views toward gifted students or programs for gifted students (McCoach & Siegle, 2007). These perceptions are often related to a belief that gifted programs are elitist, which is at odds with the perceived emphasis on egalitarianism in current reform efforts (Bain et al., 2007).

Additional potential for unproductive views by teachers emerge in their methods for identifying gifted students and their resulting expectations of gifted students. Perceptions of gifted students, such as the following, may be used as stereotypes rather than as part of a more robust definition of gifted (Bain et al., 2007; Busse, Dahme, Wagner, & Wieczerkowski, 1986; Speirs Neumeister, Adams, & Pierce, 2007):

- gifted students provide good examples in the classroom and are compliant;
- gifted students do not experience failure or frustration;
- gifted students are self-centered, neurotic, high achievers, creative, intelligent, verbally proficient, logical problem-solvers, artistic, or precocious; and
- boredom is an indication of giftedness.

Holding only one or a few of these perceptions may preclude a teacher from identifying and acting upon the more inclusive definitions of gifted, as proposed by the National Association for Gifted Children (NAGC, 2005a), "A gifted person is someone who shows, or has the potential for showing, an exceptional level of performance in one or more areas of expression" (para. 4). The final misconception presents a dilemma as students of gifted ability and students from the general population have been found to demonstrate equal levels of boredom in the classroom (Feldhusen & Kroll, 1991). Two other negative perceptions that have been found among preservice and in-service teachers include the belief that acceleration has negative social consequences (Bain et al., 2007, Colangelo, Assouline, & Gross, 2004; McCoach & Siegle, 2007) and a belief in student differences, which often results in gifted students being neglected so slower students can receive additional attention (DeLacy, 2004; Neal & Schnazenbach, 2007).

In contrast to such unproductive perceptions, Joffe (2001) detailed how a novice teacher of gifted students went from observation to responsive pedagogy with gifted students. The teacher realized that gifted students do tend to be competitive with each other, but that they are also very supportive of each other. The teacher also recognized that gifted students are often able to move quickly through material, but they may not deeply understand such material. As such, she purposely made teaching decisions that required the students to deeply engage with the material.

Features of Effective Tasks for Gifted Students

If preservice teachers are to work with gifted students in mathematics, they need to know what types of tasks are suited to meet the needs of gifted students. This is not a trivial consideration as myriad types of mathematical tasks may be used with gifted students. First, the literature suggests that mathematical problem-solving tasks of significant complexity are requisite so gifted students may be challenged (Deizmann & Watters, 2001, 2005; Sriraman, 2003). The objective in providing significantly challenging mathematical problem-solving tasks is to increase the likelihood that students will maintain interest in the content (Chamberlin, 2002). One approach to increase interest

in mathematical problem-solving tasks is to ensure that novelty exists (Deizmann & Watters, 2001).

In addition, it has been suggested that gifted students have access to problems that enable them to make generalizations in mathematics, such as through the use of model-eliciting activities (Chamberlin & Moon, 2005; Sriraman, 2003, 2005). Another characteristic to seek in mathematical tasks is the promotion of creativity (Balka, 1974; Krutetskii, 1976). Finally, mathematical tasks that enable gifted students to work together should be used as specified by Deizmann and Watters (2001).

Recommended Competencies for Teachers of Gifted Students

The literature contains numerous resources concerning effective competencies for teachers of gifted students (see Table 1), including surveys of teachers, administrators, and university personnel (Bain et al., 2007; McCoach & Siegle, 2007); observations and comparisons of novice and master gifted teachers (Bangel et al., 2006; Hanninen, 1988; Joffe, 2001); literature reviews (Tomlinson et al., 2003); and standards (NAGC, 2005b). It is important to clarify two issues. First, it is not intended that these competencies are necessarily exclusively for gifted students. Second, these competencies should not be taken as the best pedagogy for every learner. Rather, the competencies should be viewed as a repertoire from which teachers can select strategies appropriate for the diverse needs of their gifted learners at different points in time (Kaplan, 2003).

Method

During an elementary education mathematics and science methods course in fall 2006, in addition to their readings in Hiebert et al. (1997) and Llewellyn (2002), 23 elementary preservice teachers engaged in a field experience of administering a series of mathematical problem-solving tasks to groups of third- through six-grade students who had been identified as gifted. It is important to note that the

Table 1

Recommended Competencies for Teachers of Gifted Students

Topic	Description
Knowledge of needs	Educational needs of gifted students, including affective
	Theory on teaching general population and gifted students
	Content at an advanced level
Skill in promoting	High-level thinking
	Creativity
	Problem-solving activities
Development of curriculum	Differentiation
	Multiplicity of resources including out-of-class resources
	Link academic and nonacademic topics to increase student interest
	Enrichment and acceleration
Learner-centered instruction	Facilitate students' independent research
	Use assessment continually to inform instruction
	Create a safe environment
	Group instruction including ability and heterogeneous grouping
	Self-directed learning to build student autonomy
	Flexible use of classroom time and scheduling
Actions to avoid	Emphasis on rote memorization
	Overreliance on use of gifted students as tutors

term field experience has myriad conceptions in the literature, yet the National Council for Accreditation of Teacher Education Programs (NCATE) is reluctant to define what a field experience is (Singh & Stoloff, 2006). Hence, the conception of what a field experience is may often be left up to the researcher(s). For this study, the field experience consisted of three 1-hour visits on alternating Wednesday afternoons. Preservice teachers were instructed to pose problems, let students solve the problems, and then to investigate students' thinking through their explanations.

The groups of elementary students ranged from 3–5 students. The students consisted of 16 males and 15 females, 25 European American and 6 Asian American students. Four of the students qualified for free or reduced lunch. Students were selected for the gifted program in this district based primarily on their battery test score from literacy and mathematics. Thus, most students were advanced in mathematical ability (often up to the eighth- and ninth-grade level), while approximately 15% of the students were at grade level in terms of mathematical ability with an advanced level in literacy.

The preservice teachers included 20 females and 3 males, all between the ages of 21–25 and attending a medium-sized public university in the Rocky Mountain region. All preservice teachers were in their last year of preparation and student taught the semester following the field experience. No formal training on gifted students or conceptions of giftedness was provided prior to the course. Only one participant reported having worked minimally with gifted students prior to this experience. The preservice teachers worked in pairs for the entire hour with one group of gifted students and worked with the same gifted students for all three sessions.

The course was a combined mathematics and science methods course for elementary education majors taught by the second author of the paper. Prior to the experience with the gifted students, the preservice teachers developed a working definition of mathematical problem solving through discussions in the methods class. The definition consisted of four components: (a) novel to students, meaning the answer is not known prior to starting the problem; (b) more than one process may be used to solve the problem; (c) interesting, challenging, or problematic for students; and (d) realistic to students' lives (Hiebert et al., 1997; National Council of Teachers of Mathematics [NCTM], 2000). This definition is consistent with what national and state leading gifted and talented experts use for a definition of mathematical problem solving (Chamberlin, 2006). The preservice teachers then identified a series of mathematical problem-solving tasks that they could implement with their groups of elementary students. Prior to implementation, they submitted a sample of these tasks to the assistant professor to ensure they had enough tasks to use with the students. Up to this point, no explicit instruction on gifted education had occurred in the methods class. It was desired that the pre- and

post-journals reflect the impact of the preservice teachers' experiences with the gifted students and not the preservice teachers' perceptions of what they thought the instructor might want to hear.

Once the field experiences began, the methods instructor still avoided direct instruction on gifted education. However, informal, out-of-class discussions did occur among the preservice teachers between their 1-hour sessions with the gifted students. The preservice teachers discussed how their sessions went, how their students behaved, how their students solved or thought about the associated problem-solving tasks, and so forth. After the third session with the gifted students and after the post-journals had been turned in, the instructor deliberately addressed gifted education in the methods course. Class topics included the varying needs of gifted students, ways to address such needs, and how to differentiate and telescope instruction to better meet the needs of gifted students.

Written data were collected from the preservice teachers through a journaling assignment. The pre-journal was assigned and collected before the preservice teachers worked with the gifted students. The post-journal was collected 2 weeks after the preservice teachers' three sessions of working with the gifted students. The prompt for each journal follows:

- Pre-Journal: Detail what you expect to see when administering mathematical problem-solving tasks with gifted elementary students. In particular, explain characteristics you expect the gifted students to exhibit, characteristics of mathematical problem-solving activities that you think will be most effective with the gifted students, and your role in teaching the gifted students.
- Post-Journal: Go back to your first journal entry regarding what you expected to see when administering mathematical problem-solving tasks with gifted elementary students. Were your expectations fulfilled or did they deviate from what you expected with respect to characteristics of the gifted students, characteristics of effective mathematical problem-solving tasks, and your role in teaching the gifted students? Be sure to also explain what aspects of the experience caused you to maintain or alter your expectations.

The preservice teachers were told that each journal should be approximately two to three pages in length, should address all three areas of the prompt, should be detailed, and should include explanations and justifications for their perceptions. In addition, they were recommended to write a first draft and then self-assess it or ask a peer to review it.

Upon collecting the preservice teachers' pre- and post-journals, their names were replaced with an identification code and the journals were saved electronically. The journals were analyzed using the procedures of grounded theory (Strauss & Corbin, 1998). The unit of analysis was the collection of preservice teachers. In the sections that follow, quotes should be taken as illustrations of themes that emerged among the collection of preservice teachers.

To begin the analysis, each researcher separately open coded both journals for recurring themes. Next, the researchers together used HyperResearch, a qualitative analysis software program, to finalize, agree upon, and record the open codes and their respective associated quotes. Using the software program, the quotes were sorted and printed according to code and pre- or post-journal. Then, together the researchers read through these printouts and used the associated quotes to focus more on axial-coding (although open coding continued as needed). This process included noting the frequency of various codes and delineating each code by fully describing it, who mentioned it, when, why, and with what effect.

The codes were sorted according to the three main components from the journal prompts: the preservice teachers' perceptions of gifted students, characteristics of effective mathematical problem-solving tasks for gifted students, and effective pedagogical strategies for gifted students. Concept maps and outlines were then used to summarize the perceptions of the preservice teachers on the pre- and post-journal. For each result, the number of preservice teachers reporting that theme on the pre-journal and the post-journal is provided, along with the number of teachers who overlap—those who reported the idea on both journals. One should note that these counts are based on responses to open-ended journal prompts. Thus, the counts should be considered as a lower bound for the number of preservice teachers that may agree with a particular type of comment.

Results

Preservice Teachers' Perceptions of Gifted Students

The journal prompts asked the elementary preservice teachers, hereafter referred to as teachers, to describe characteristics they expected the gifted students to exhibit. These characteristics fell into four groups: cognitive, affective, engagement, and other characteristics.

Cognitive characteristics. The teachers (n = 18) expected the gifted students to exhibit critical, higher level, abstract, advanced, beyond grade level, and/or complex thinking and/or to possess strong problem-solving abilities. As Barb (a pseudonym, as are all names) remarked,

> I expect to see a higher level of thinking and performing. First, when looking at the problem-solving content, I believe I would see more advanced answers to the problem being asked. In addition, I believe the students would use more critical thinking skills to answer the problem at hand.

These characteristics were confirmed in their observations of gifted students, which 14 of the teachers reported (12 overlap). Kelly explained, "We saw a lot of higher level thinking with several of the problems we presented." On the pre-journals, two teachers suspected that the gifted students may sometimes arrive at incorrect answers, and three teachers expected the gifted students to always provide correct answers. On the post-journals, these three teachers along with one additional teacher noted that the gifted students were not always correct. As Samantha commented, "I thought that they would be able to do the math problems with no problems. This, however, is not true." Three of these four teachers also noted the students' insistence on their answers being correct or their lack of questioning whether their answer was correct.

Here is an example of the counts we provide for each result: With regard to students exhibiting critical, higher level, abstract, advanced, beyond grade level, and/or complex thinking, 18 teachers reported this idea on their pre-journal, 14 teachers reported this on their post-

journal, 12 of whom were the same as those for the pre-test. Twelve teachers overlapped with regard to this result.

The teachers also expected and reported observing the gifted students using creative and unique approaches (11 pre, 8 post, 8 overlap), solving problems with multiple solutions (9 pre, 9 post, 4 overlap), drawing on prior knowledge (6 pre, 3 post, 2 overlap), and working at a fast pace (9 pre, 9 post, 4 overlap). Carol commented on the uniqueness of the students' work:

> Some of the characteristics I expected the gifted students to exhibit were unique approaches to problems. I definitely saw this in the students I worked with. Each of them had a different way to go about the problem and some of which were ways I had never thought of.

With regard to using multiple solutions, Nancy wrote, "A lot of the students would come up with different ways of solving the same problem and then we would challenge them to find other ways to solve the same problem." Chandra commented, "I couldn't believe how many different ways these three young kids could do their math problems and they are so fast!"

Some of the teachers ($n = 5$) expected that gifted students would struggle with explaining their work or answers. As Deb explained, "Gifted students may be able to arrive at the correct answer to a problem, but may not be able to explain how they came to the conclusion." In contrast, two of the teachers felt that the gifted students would be "able to communicate their ways of understanding" (Jill). On the post-journals, four teachers noticed that the gifted students were able to determine answers to the problems, but were not able to explain their thinking. They commented that the students quickly determined the answer, often in their head, and then found it difficult to explain how they determined the answer:

> I actually found that sometimes it was hard for them to explain their work. This was a result of them working parts in their head or they just saw how the problem worked and it was hard for them to explain how they saw it. (Carol)

Three additional teachers noted that without prompting, the gifted students did not explain their thinking or show their work. As

a final point, two other teachers did comment that some of the gifted students were able to explain their thinking and some were not. As Jill shared,

> One student took many different and unique steps to find an answer and was able to explain each step and why that step was important. The other student had the ability to see the answer quickly and therefore had a more difficult time breaking down that understanding and communicating it.

Affective characteristics. The teachers expected and observed that gifted students would have high motivation or interest (8 pre, 6 post, 4 overlap). On the pre-journal, Deb wrote, "While I am working with students who are gifted, I will expect to see high ability, creativity, and motivation." On the post-journal, she wrote, "These students used this ability to become motivated and excited about each problem-solving task." Jill qualified this interest however by saying, "it [their interest] really depended on the problem and how challenging it was for them." Also, Janet found that the gifted students were not always highly motivated or interested, "I thought they would be more excited, but I think they felt that we were just providing more or different work for them to do."

Some of the teachers also noted the gifted students' perseverance in working on the problems (4 pre, 8 post, 2 overlap). As Melissa wrote, "Some of the problems we had the students do were complicated, but the students stuck to them and would not stop working on the problems until they had them figured out." Some of the teachers described independent or autonomous learning on behalf of the students: "I originally thought that if the students were gifted in math, then they could self-guide their investigations and I was definitely right on that one" (Chandra; 5 pre, 4 post, 0 overlap). However, on the post-journals, three of the teachers commented that they were surprised that the gifted students did seek help from them, "In this situation, I found myself being more of an aide to the students than I thought I would. I thought the students would want to work alone and not have teacher help. I was wrong" (Molly). Finally, some of the teachers had comments with regard to whether gifted students experience frustration in completing mathematical activities. On the pre-journals, three teachers felt that the gifted students might experience

some frustration; on the post-journals two different teachers commented that they saw the gifted students experience frustration. As Carol wrote, "I saw some frustration when they were not on the right track after a period of time."

Engagement. Some of the teachers were concerned about gifted students becoming off-task or off-topic (9 pre, 7 post, overlap 3). On the pre-journals, their concern was related to perceptions that gifted students, if not challenged, may become bored and therefore off-task or that gifted students are very creative and energetic and therefore will become off-topic. Chandra commented, gifted students "can be disruptive due to being bored with the material." Barb remarked,

> Because gifted students are so creative and advanced in critically thinking about how problems should be solved and many times will begin to brainstorm about a topic which maybe at one point dealt with the problem but then has become off of the topic, I believe the teacher needs to help them refocus.

On the post-journals, the teachers focused on their experiences with the students. For some of the teachers (9, 3 overlap), the gifted students were off-task and they had to ensure that the students returned to task. Many of these teachers noted the relationship between the difficulty of the task and the students' engagement, "I also noticed the easier the problems, the more off task the students would get. Once the problems became more difficult the students became fully engaged" (Molly). Carol realized that gifted students may or may not be off-task. She wrote,

> I expected these students to be very focused on math and not stray too far from the topics, however, on a few occasions we had to remind them to stay on task. Even with gifted students they may stray from where you think their minds should be.

Three of the teachers who expected the gifted students to be off-task experienced otherwise:

> I, at first, thought the goal in teaching gifted students would be to keep them on task. This was not a problem at all. The three students I worked with were always on task and willing

> to work hard for me. They continuously wanted to work on problems that they thought could "stump" them. (Deb)

Two of the teachers noted on their pre-journals that the gifted students would want to find the quickest answer or method for solving a problem, and two more teachers identified this in their post-journals. As Carol wrote, "I found that they were straightforward and were mostly thinking of the quickest and most efficient way to get the answer, not the most creative."

Other characteristics. The teachers also noted some other characteristics that did not fall under the previous categories. First, some of the teachers (3 pre, 3 post, 0 overlap) noticed that gifted students are not necessarily gifted in all areas or that although students may be gifted, they do not necessarily learn the same way or have the same abilities. Alicia explained,

> Gifted means that in most subject areas they learn more proficiently and effectively than the other students in the classroom do. However, each gifted student learns differently and needs to be taught in a manner that is most effective for their learning processes.

Second, three of the teachers realized that the students were somewhat competitive with each other. Kelly noted, "they were a little on the competitive side but they also wanted to make sure that each other understood the problem." Third, on the pre-journal, one teacher felt the gifted students would, "socially be behind their peers" (Molly) and one teacher felt that, "with the gifted students . . . you should expect the same social problems to arise as you would with the at-grade-level students" (Melissa). On the post-journals, Molly and Melissa reiterated these comments, while Jill, Samantha, and Amanda were concerned that being placed in a self-contained gifted setting was not allowing the students to develop skills for socializing with other students and in fact may lead gifted students to, "become elitist and snobbish; they tend to think of themselves as better individuals than others and that becomes a problem" (Amanda). Finally, many of the teachers (0 pre, 8 post) noted that they were amazed or shocked by the gifted students' abilities and quickness and that they learned additional approaches to the problems from the gifted students (0 pre, 7 post). Carol expressed

her amazement, "I was amazed by some of the problems they quickly solved when many of us college students had difficulty finding the solution." Five of the teachers commented that because of these novel approaches, they could learn from the students, "I now know that I can learn from them as well as they can learn from me" (Jason). Table 2 summarizes the teachers' perceptions of the gifted students.

Perceptions of Characteristics of Effective Problem-Solving Tasks for Gifted Students

The most commonly cited expectation and finding was that the mathematical problem-solving tasks must "challenge" the gifted students (18 pre, 16 post, 13 overlap) at an appropriate level (9 pre, 11 post, 3 overlap). The teachers wanted to challenge the students, often by giving them a problem "slightly above their ability" (John) or by using a task more "difficult" (Melissa) than one posed to general students, while still ensuring that the gifted students could complete the problem and not become "frustrated" (Missy). Nancy wrote,

> As stated before, the content for a gifted child should be challenging for the student, but not too easy or too difficult. If the content is too hard, then the student will shut down and the lesson will not be learned. If the content is too easy, the student will become bored and could then become a distraction in your classroom. This I found to be very true.

As evidenced in Nancy's comment, many of the teachers expected and found that using challenging problems enabled them to maintain the interest, motivation, or engagement of the gifted students (8 pre, 7 post, 3 overlap). Moreover, some of the teachers noted that using challenging problems promoted higher levels of thinking and learning (6 pre, 7 post, 2 overlap), "The last time was the best experience for the students and me as a teacher. The problems were perfect. . . . I felt that they challenged them and created a higher order of thinking" (Eric).

The other common theme was that the tasks should elicit critical, in-depth, above grade level, or higher order thinking or be inquiry based (12 pre, 10 post, 6 overlap). As Jason wrote,

Table 2

Elementary Preservice Teachers' Perceptions of Gifted Students

Result	Frequency in Pre-Journal	Frequency in Post-Journal	Frequency on Both Journals: Overlap
Cognitive Characteristics:			
Exhibit critical, higher level, abstract, advanced, beyond grade level, complex thinking, or strong problem-solving abilities	18	14	12
Always provide correct answers	Agree: 3; Disagree: 2	Disagree: 4	0
Insistence on correctness of, or fail to check work	0	3	0
Develop creative and unique solutions	11	8	8
Use multiple solutions	9	9	4
Draw on prior knowledge	6	3	2
Work at fast pace	9	9	4
Struggle with explaining their work	Agree: 5; Disagree: 2	Agree: 4	0
Without prompting, do not explain their work	0	3	0
Affective Characteristics:			
Have high motivation or interest	8	6	4
Perseverance	4	8	2
Seek help from the teacher	0	3	0
May experience frustration on tasks	3	2	0
Engagement Characteristics:			
Frequently became off-task or off-topic	9	7	3
Rely on quickest answer or method to solve task	2	2	0
Other Characteristics:			
Learn differently and are not necessarily gifted in all areas	3	3	0
Competitive with each other	0	3	0
Socially behind peers or hindered due to exclusive program	2	5	2
Teachers amazed by students' abilities and quickness	0	8	0
Teachers realized they could learn from the students	0	7	0

> Characteristics of mathematical problem-solving activities that I thought would be most effective with gifted students was [*sic*] the problems were above their grade level, the problems related to real life, and the problems required critical thinking. These expectations were correct.

A few students did comment that these characteristics would make the problems longer for the gifted students to complete (2 pre, 1 post, 0 overlap), would support the students' learning (1 pre, 8 post, 0 overlap), or would maintain the students' interest and engagement (0 pre, 2 post).

The teachers also mentioned that the problems should be interdisciplinary or realistic (7 pre, 4 post, 2 overlap), open-ended and allow for multiple solution paths or solutions (8 pre, 4 post, 2 overlap), foster creative and unique thinking (6 pre, 0 post), be interesting to the students (5 pre, 5 post, 2 overlap), take longer to complete (3 pre, 0 post), involve performing multiple steps (2 pre, 2 post, 1 overlap), and be hands-on (3 pre, 1 post, 1 overlap). The following quotes illustrate these characteristics:

- I thought that the problems should be interesting to them and appropriate for their maturity level. I felt making the problems interesting to them such as using the pizza problem increased their engagement and they were more focused. (Carol)
- I also noticed that problems with multiple steps were good for my students. . . . the three students were very involved and interested in solving the problem. (Deb)
- Activities for gifted students should be hands-on (if possible), involve higher level thinking and engage students in experimentation. Through this students will really enjoy working on problems. (Allison)

Some of the teachers (8 pre, 3 post, 3 overlap) mentioned that they would have extra work or extensions available for the gifted students to work on when they completed their other work. As Kelly wrote, "you always need to have extra work set aside in case they get done earlier than what you think." In their comments, these teachers also revealed that they felt these extra problems should not simply be "busy work" (Allison), but rather they should be more challenging, possibly above grade level, and "stimulate their brains" (Kelly).

Table 3

Elementary Preservice Teachers' Perceptions of Effective Mathematical Problem-Solving Tasks for Gifted Students

Result	Frequency in Pre-Journal	Frequency in Post-Journal	Frequency on Both Journals: Overlap
Be challenging	18	16	13
At an appropriate level	9	11	3
Should elicit critical, in-depth, above grade level, higher order thinking, or inquiry	12	10	6
Be interdisciplinary or realistic	7	4	2
Be open-ended and allow for multiple solutions	8	4	2
Foster creative and unique thinking	6	0	0
Be interesting to the students	5	5	2
Take longer to complete	3	3	0
Involve multiple steps	2	2	1
Be hands-on	3	1	1
Teacher needs to have stimulating extra work or extensions for students	8	3	3

Table 3 summarizes the teachers' perceptions of effective mathematical problem-solving tasks for gifted students.

Perceptions of Effective Pedagogy for Gifted Students

Differentiating instruction. On the pre-journals, 11 of the teachers acknowledged the need to adapt instruction for students. As Missy described, "In terms of pedagogy, the instructor must . . . try to adapt instruction to meet the needs of all students. Although I think this is a very difficult task, it is crucial to the success of all students." Missy and several additional teachers mentioned a necessity of adaptation for all students, not just for students in gifted education or in special education. Five teachers explicitly commented that teachers need to work on meeting the needs of their gifted students as much as

working on meeting the needs of students in the general population and students with special needs. Chandra recommended,

> Take as much interest and devotion to the [gifted] students' studies just like you would a special ed. student. Often teachers can forget about these [gifted] students because they aren't the ones that seem to need the attention and help that the struggling student does.

The emphasis upon such adaptations was to maximize learning, as Chandra further commented:

> Even though these students are all gifted doesn't mean that they all learn the same. Due to this I would have to adapt my teaching styles to fit every student's needs as much as I could to ensure maximum learning.

On the post-journals, only three of these teachers explicitly mentioned adapting their instruction for students. However, based upon some of the other teachers' comments that will be described below, it is apparent that they too were attending to the need for differentiation.

The literature describes differentiating instruction through the use of acceleration and enrichment (Gavin et al., 2007; Reis, 2007). In this investigation some of the teachers did describe the need to accelerate (7 pre, 3 post, 2 overlap) or enrich (7 pre, 2 post, 0 overlap) material for their gifted students. Their descriptions of acceleration fell into either using material that was "above grade level" (Jason) or "advanced" (Jill). For enrichment, they described using "more in-depth" (Kelly) problems or asking students to further investigate a topic or task (Tess).

While the teachers' pre-journals often described the need to differentiate, the challenges and difficulties with doing so arose in the teachers' post-journals. On the post-journals, 12 teachers commented on the difficulty of determining cognitively appropriate tasks for their gifted students. As Carol explained, "It was hard to figure out appropriate problems for them that would be challenging, yet in the beginning, I said it is important for a teacher to recognize these things [the need to adapt instruction]." Fourteen of the teachers mentioned that in order to differentiate, they needed to know the students, "The only thing I wish we could change is getting to know the students and

the student's capabilities and grade level before we started spending their math hour with them" (Molly). Twelve of the teachers reported that they started with tasks that were too easy for the gifted students. Vanessa wrote, "Our first set of problems was way too easy. I think Molly and I greatly underestimated their abilities. The second and third sets were more complex." Finally, 10 of the teachers acknowledged that some differentiation may be required during a teaching moment in the form of probing questions. As Tess explained,

> It was challenging and a great opportunity to think on your feet. I learned that it was important to be flexible and adapt. There were a few problems that I thought would take them longer, yet they did them in two minutes. This is where Allison and I would transform the problem, add other factors, and then challenge the students again.

Teacher actions. Many of the teachers felt that with the gifted students they should use little to no direct instruction. They felt that they should use student-centered instruction and serve as a facilitator (11 pre, 6 post, 4 overlap). On the pre-journal, Tess explained,

> I don't think that a long lecture or detailed explanation of the task is necessary. I expect that gifted students don't want a teacher-centered classroom and detailed instruction. I see the students as being very independent and self-motivated. I think that a facilitator role would be much more appropriate.

On the post-journal, she acknowledged, "My expectation of acting as more of a facilitator and guide was true." Many of these same teachers also commented that, as the students are working on problems, it is their job to support or guide the students. However, the primary responsibility for solving the problems still resides with the students (9 pre, 11 post, 5 overlap). Carol explained the role that she found to be most fruitful:

> I found that guiding them is vital, not showing or telling, but allowing them to work through the problems with only guidance from the teacher. It is best for the teacher to use probing questions to guide them on track, but not give answers or clues.

Despite this role as facilitator, some of the teachers acknowledged that the gifted students still needed the guidance of their teacher (5 pre, 4 post, 3 overlap). Kelly noticed that "they did not feel embarrassed when they did not understand the problem or needed additional help."

As a facilitator, some of the teachers described presenting the students with the task and then allowing the students to work on the problem autonomously (4 pre, 3 post, 2 overlap):

> At first, I think the teacher should allow students to brainstorm various ideas and solutions to the problem-solving task given to them. Students should be given plenty of time to think critically about the problem and reason about which solution they believe will solve the problem the best. (Barb)

Also, in their facilitator role, the teachers described that they should or did ask the students about their thinking on a problem (3 pre, 6 post, 0 overlap), especially since the gifted students did not always do so without being asked. As Janet explained, "I also thought they would be more talkative, but they worked quietly and we had to question what they were doing in order to find out about their thought processes." Many of the teachers mentioned questioning the students to stimulate their thinking, to refocus them on the problem at hand, to understand the students' thinking, or to challenge the students in their thinking (6 pre, 9 post, 2 overlap):

> It is very important for the teacher to understand the students' understanding and to build on it. While working with these students, I was putting most of my efforts towards this. Once I was able to understand the students' method for understanding a task, I was able to ask challenging questions to further understanding. (Jill)

Some of the teachers commented that they would use or that they found cooperative learning beneficial for the gifted students (4 pre, 3 post, 1 overlap). Tess explained,

> I expected that group work would be a powerful tool in the problems we chose and this expectation also was a reality. Each student had different strengths and ideas and by shar-

> ing their thoughts or methods they were able to assist each other to solve problems.

On the pre-journal, Nancy and Vanessa expected that gifted students would work well in groups, and Tess and Kelly reported on their post-journals that they experienced the students working well in groups. In contrast, Jill and Nancy reported that the students did not work well together:

> The other thing I noticed about these problems is that each of these students went about solving them in a completely different way. This was really neat to see, but it also formed a barrier that caused the students to not want to work together. (Jill)

Only two teachers talked about whether to group the gifted students with each other or with general population students. Perhaps because the teachers were working with students in a self-contained gifted class, they did not think to discuss this issue. Allison suggested that if an aide were available, it would be helpful to ability group the gifted students so that they may go at a faster pace. Amanda mentioned that there are pros and cons to ability grouping and tracking. Ability grouping allows students to proceed at a pace appropriate for them, but as Amanda stated:

> In the content areas where a lot of discussions take place, if you have a group of lower skilled students, you lose the higher students to help lead those discussions; likewise lower students often have great ideas and can bring a different viewpoint that many others might miss.

Finally, some teachers (3 pre, 1 post, 0 overlap) mentioned that the gifted students should tutor or teach general population students. Sylvia wrote, "In some instances, the content might not be flexible. If this happens, the gifted students should complete the assignment and be used as a resource to help the other students if needed."

On the pre-journals, some of the teachers were concerned about avoiding actions or attitudes that would segregate the gifted students from the general population or special needs students. As Carol explained, she desired to "build a community within the classroom." Sylvia wanted to "push them [gifted students] to think beyond the

problem without segregating them from their classmates." Jill focused more on attitudes and perceptions saying,

> It is important for a teacher to avoid gifted students to be viewed as "better," "smarter," or as "the favorites." It is also important for gifted students to be challenged by the content of a class. Therefore the teacher must find creative ways to challenge gifted students without putting such students on a pedestal.

Kelly and Samantha presented the example in reading that they would provide students different books based on ability level and while doing so try to "allow students to read books they like without being embarrassed if they read below grade level." Such concerns did not appear on the post-journals, although three teachers did express concern about the students being in a gifted-only program. They felt this segregation would hinder their social abilities. Table 4 summarizes the teachers' perceptions of effective pedagogy for gifted students.

Links Between Perceptions of Gifted Students and Perceptions of Effective Tasks and Pedagogy

The teachers' perceptions about gifted students, effective tasks, and pedagogy for gifted students were intertwined. Due to the teachers' perceptions of the kind of thinking possible by gifted students, including thinking that is at a higher level, more critical, abstract, advanced, complex, and creative, the teachers felt that effective tasks for gifted students should foster and elicit such thinking. Because the teachers perceived gifted students to be faster at completing work and to have a tendency to get off-task, the teachers also wanted to be sure the tasks challenged the students and took longer to complete and to have extra work available.

The teachers' perceptions of gifted students also impacted their pedagogical ideas. First, because the gifted students appeared to be independent, perseverant, and self-guided in their learning, the teachers felt their role should be largely as a facilitator. Second, because the gifted students struggled with or would not explain their thinking at times, the teachers felt it was part of their role to ask the students to explain and record their thinking.

Table 4

Elementary Preservice Teachers' Perceptions of Effective Pedagogy for Gifted Students

Result	Frequency in Pre-Journal	Frequency in Post-Journal	Frequency on Both Journals: Overlap
Differentiating Instruction:			
Need to adapt instruction for all students	11	3	3
Need to accelerate	7	3	2
Need to enrich	7	2	0
Difficult to determine cognitively appropriate tasks for students	0	12	0
To differentiate, need to know the students	0	14	0
Started with tasks that were too easy	0	12	0
Some differentiation may need to occur during the activity through probing questions	0	10	0
Teacher actions:			
Use little to no direct instruction; instead serve as a facilitator or use student-centered instruction	11	6	4
Responsibility for solving the task resides with the students	9	11	5
Present students with the tasks and then allow them to work autonomously	4	3	2
Ask the students about their thinking on the tasks	3	6	0
Question students to stimulate thinking, refocus students, or to challenge students	6	9	2
Use cooperative learning	4	3	1
Ask gifted students to tutor other students	3	1	0
Avoid actions that segregate gifted students from other students	5	3	0

Discussion

Comparison of Perceptions of Gifted Students to Literature

One of the main concerns about beginning teachers is that they will be apathetic toward gifted students' needs, believing that gifted students will succeed without educational interventions (Bain et al., 2007; Tomlinson et al., 1994). Fortunately, the teachers in this study did not convey this perception. It appears that the upcoming field experiences may have made them aware of the necessity to meet the needs of gifted students.

Unfortunately, however, neither the methods class nor the field experience appeared to diminish some of the teachers' concerns that gifted programs or adaptations may be elitist (Bain et al., 2007). On the pre-journal, five of the teachers wanted to avoid actions that would segregate the gifted students from the other students not gifted in their discipline. On the post-journal, three of the teachers were concerned about the exclusivity of the students in this gifted-only classroom. They felt such an arrangement would hinder the gifted students from developing socially or would lead them to hold elitist views about themselves (Bain et al., 2007; McCoach & Siegle, 2007). Furthermore, some of the teachers suggested using the gifted students to tutor or teach concepts to other students. Often such comments seemed driven by the need to develop a sense of community in the classroom without potentially identifying any differences. Combining a field experience with students in a gifted-only as well as in an inclusive setting may help to elicit some of these issues that could be discussed in the methods class. Comparing and contrasting both settings may enable the teachers to experience the pros and cons of inclusive versus self-contained arrangements, such that they would learn to value the advantages and disadvantages of each arrangement. In addition, these issues should be addressed through course readings and associated in-depth discussions in education courses.

The literature reported earlier also listed many characteristics of gifted students. It was noted that while such characteristics are often exhibited by gifted students, they should not be taken as stereotypes

of all students or as rigid requirements for identification of gifted (NAGC, 2005a). As might be expected, the teachers perceived that gifted students would exhibit high levels of thinking, be creative, solve problems with multiple solutions, draw on prior knowledge, work at a fast pace, have high motivation and interest, persevere in solving tasks, and be independent and self-guided in their learning. On the pre-journals, it does appear that some of the teachers held these expectations in rather stereotypical ways. Consider the following quote:

> In the classroom when you are teaching and having your students do math problems, you will notice students who finish their work early and usually correctly. These students are probably your gifted students who are working above grade level. Academically they are advanced, but because of their normal social skills, they may be your troublemakers unless they are occupied and challenged. (Melissa)

In contrast, 21 of the 23 teachers made at least one comment that revealed they were developing a more robust and varied description of gifted students. For example, Missy wrote,

> I suppose I always thought gifted students possessed some magical power that allowed them to instantly count a box of spilled toothpicks (think Rain Man) or know the square root of a 10 digit number. Even though these super-human people do exist, I felt the group I worked with was simply intelligent, hard-working students who are truly interested in math.

Teacher insights included in this theme were:

- students' levels of interest largely depends on the problem task;
- not all gifted students have high motivation or interest;
- although gifted students may be self-guided in their learning, they still need some assistance from the teacher;
- gifted students can experience frustration in solving a task;
- gifted students are not always correct in their work;
- gifted students may be insistent about the correctness of their work or fail to question their results;
- gifted students may struggle with or not explain their thinking without prompting;
- gifted students may not be on-task;

- gifted students are not necessarily gifted in all domains nor do all gifted students learn in the same fashion;
- gifted students often seek the quickest answer; and
- gifted students may be competitive but tend to still be supportive of each other.

Sixty-nine percent of these insights occurred on the teachers' post-journals, supporting the literature that one way to impact teachers' beliefs and attitudes is to have them work directly with the students (Bangel et al., 2006; Bégin & Gagné, 1994a, 1994b; Feldhusen & Huffman, 1988).

Comparison of Perceptions of Effective Tasks for Gifted Students to Literature

Many of the characteristics for effective tasks proposed by the teachers matched the recommendations in the literature (Chamberlin, 2002; Deizmann & Watters, 2001, 2005; Sriraman, 2003). The teachers stated that problem-solving tasks should be challenging, elicit high level thinking, promote interdisciplinary or realistic connections, be open-ended, foster creative thinking, involve multiple steps, and be hands-on. However, teachers mentioned the previous characteristics much less frequently on their post-journals (11 comments) than they did on their pre-journals (26 comments). This appears to indicate a shift in the teachers' focus from considering characteristics of the problem-solving tasks to considering how the gifted students reacted to and worked on the tasks. According to the Concerns-Based Adoption Model (Hall & Loucks, 1979), this may indicate that the teachers' concerns shifted from management, in which their main concern was about the logistics of implementing the problem-solving tasks, to consequence, in which their main concern was about how the tasks were affecting the students.

Comparison of Perceptions of Pedagogy for Gifted Students to Literature

In writing about differentiating instruction in the pre-journals, the teachers described the need to adapt instruction for students,

including the gifted. On the post-journals, the teachers wrote about the challenges they faced in adapting their instruction. The most common theme in the teachers' comments aligning with the literature was the need to "know the students" in order to better select appropriate problem-solving tasks for them. This suggests that the teachers came to understand that gifted students are not all alike in their needs. The literature is replete with suggestions that differentiation needs to be learner-centered, meaning it builds on student knowledge, relies on ongoing assessment of learner understandings, and focuses on student sense-making. "In differentiated classrooms, teachers begin where students are, not at the front of a curriculum guide" (Tomlinson, 2002, p. 21). The teachers mentioned that they wished they could have gotten to know the students before selecting their first set of problem-solving tasks, an indication that they were hoping to begin where the students were.

Too often differentiation is perceived as a reactive process in which "the teacher plans one lesson for everyone and tries to adjust on the spot when students signal the lesson isn't working for them" (Tomlinson et al., 2003, p. 132). Rather, it should be more proactive if "the teacher plans a lesson that will, from the outset, address learner variance" (Tomlinson et al., 2003, p. 132). In selecting tasks for the gifted students, the teachers were taking proactive steps to differentiate their instruction. However, it was not apparent that they were making proactive adjustments to these tasks for the different individuals within their groups. Also, after the field experience with the gifted students, many of the teachers commented on their role in asking questions of the students. For some of these teachers, the purpose of asking such questions was to challenge the students. This may mean that these teachers were left with an impression that reactive differentiation is more effective than proactive differentiation. However, to truly differentiate instruction, it takes more than just asking gifted students to answer a few more complex questions on an activity or concept. In addition, being proactive includes more than just planning to ask gifted students to complete extra work. Some of the teachers spoke of the need to have extra work available for the gifted students to work on when they completed their other tasks. Fortunately, however, the teachers felt that such work should be mentally stimulating.

Two other effective differentiation strategies from the literature that the teachers mentioned, although with lesser frequency, include the need for teachers to respond to the fact that learners differ in important ways and that effective differentiation employs flexible use of small groups. Other strategies for differentiation that appear in the literature were not mentioned by the teachers, likely because the teachers were working with students in a gifted-only setting and were not confronted with the requirement to meet the gifted students' needs while also meeting the needs of other students. These included using variable pacing; blending whole-class, group, and individual instruction; and varying materials used by individuals and small groups.

In addition to pedagogical strategies for differentiating, the literature describes alternative means by which a teacher can differentiate. One means to differentiate instruction is in response to student readiness, interest, and learning profile (Tomlinson et al., 2003). The teachers appeared to differentiate based on the needs of student readiness; several of them spoke of the need to challenge students at the right level such that they were not bored but not frustrated either. With regard to interest, some of the teachers did describe the need to use tasks that were interesting to the students. Differentiating based on learning profile was not mentioned by the teachers. This process was not discussed in the methods class. Perhaps this topic should be discussed in methods classes in order for preservice teachers to try utilizing such strategies. Focusing on the structure of the task is another way to differentiate. One can alter the content, process, product, or learning environment of a task (Tomlinson, 2002). The teachers primarily differentiated their instruction by altering the content of the problem-solving tasks. Again, perhaps discussing in the methods class the other avenues for differentiating would be beneficial.

With regard to the teacher actions proposed by the teachers, their journals aligned with some of the literature's recommended teacher competencies. One competency was skill in promoting higher level thinking, creativity, and problem-solving abilities. Although this study did not gather observational data about the teachers' skill in instructing the gifted students, the teachers did describe the need for tasks that elicited such aspects. In terms of adapting instruction, data suggest that the teachers valued and made efforts toward adapting their problem-solving tasks to meet the readiness of their students.

The ability to develop appropriate and challenging curricular units also included the recommendation to link academic and nonacademic topics in order to extend students' interests outside the classroom. Some of the teachers did mention that they felt effective tasks for the gifted students were interdisciplinary or realistic. In addition, many of the teachers' comments reflected attempts to offer student-centered instruction.

As a caveat, some of the recommended competencies were not observable within this study due to the structure of the field experience; the teachers were working only with small groups of gifted students and were asked to specifically implement mathematical problem-solving tasks. Thus, it is not feasible to describe their abilities to facilitate students' independent research, to differentiate in an inclusive classroom, to build students' responsibility through self-directed activities, to respond flexibly with classroom time and scheduling, to create a safe environment, to effectively use group instruction, and to draw upon a multiplicity of resources.

Limitations

Several concerns exist with the analysis of data. For instance, the concern of the rather short amount of time students invested with identified gifted students (3 hours), the small number of participants, and the small amount of data (restricted to pre- and post-reflections) may have impacted the interpretation of the data. In an attempt to systematize the analysis, the data was analyzed qualitatively using grounded theory (Strauss & Corbin, 1998). Suggestions for how to ameliorate these concerns rests in expanding the study to encompass a larger number of student interaction hours and increasing the number of participants and therefore data. The data analysis approach may then be altered to be quantitative and to see if this new data supports the existing data in this study.

Future Directions and Impact

In this study, creating a field experience that enabled preservice teachers to work with gifted students enhanced the teachers' perceptions of

the needs of gifted students. The focus of the activity was to dispel the notion among preservice teachers that all gifted students are the same; rather, each one is an individual. As researchers continue to examine how such field experiences are productive, some directions for future research as well as ways to enhance the field experience may be helpful. With regard to research, it would be advantageous to incorporate observations of the preservice teachers working with the gifted students. Such data could supplement the self-report data of teacher journals, as used in this study. Existing instruments for observing teachers' instruction with gifted students may be used, such as those found in VanTassel-Baska, Quek, and Feng (2007) and Feldhusen and Huffman (1988). For the field experience, it would be helpful to place the preservice teachers in inclusive as well as self-contained settings with gifted students. It would also be helpful to include time for the teachers to determine their own pedagogical plans rather than being directed to specifically implement mathematical problem-solving tasks. Both of these modifications would place the preservice teachers in a situation of learning to instruct gifted students in general classroom settings.

Furthermore, we realized after the analysis that some of the preservice teachers' reactions may have been reactions to a field experience in general and not necessarily the result of working specifically with gifted students. For example, many of the teachers' realizations about effective mathematical tasks and pedagogy may have arisen from any field experience, including the need for interdisciplinary, open-ended, interesting, and hands-on tasks and the use of student-centered instruction, questions to probe students' thinking, and cooperative learning. Although realized too late for the methods course here, other instructors may find it helpful to have discussions with the preservice teachers to delineate which of their observations were specific to gifted students and which may be germane to all students. Such discussions may help preservice teachers realize that instructional strategies effective for gifted students are often as effective and just as needed for all students, while still attending to the individualized needs of students with gifted abilities.

This study helps build the literature about preservice teachers learning from experiences with gifted students. In this context, teachers recognized the need to adapt instruction for gifted students as well

as other students, made sincere efforts to match their mathematical problem-solving tasks to their gifted students' readiness and interests, broadened their views of giftedness, realized the necessity of knowing students to differentiate instruction, and emphasized student-centered instruction for gifted students. These results support the benefits of having teachers supplement gifted education courses with experiences of working with gifted students in actual classroom settings.

References

Bain, S. K., Bliss, S. L., Choate, S. M., & Sager-Brown, K. (2007). Serving children who are gifted: Perceptions of undergraduates planning to become teachers. *Journal for the Education of the Gifted, 30,* 450–478.

Balka, D. (1974). Creative ability in mathematics. *Arithmetic Teacher, 21,* 633–636.

Bangel, N., Enersen, D. J., Capobianco, B., & Moon, S. M. (2006). Professional development of preservice teachers: Teaching in the Super Saturday Program. *Journal for the Education of the Gifted, 29,* 339–361.

Bégin, J., & Gagné, F. (1994a). Predictors of attitudes toward gifted education: A review of the literature and blueprints for future research. *Journal for the Education of the Gifted, 17,* 161–179.

Bégin, J., & Gagné, F. (1994b). Predictors of a general attitude toward gifted education. *Journal for the Education of the Gifted, 17,* 74–86.

Busse, T. V., Dahme, G., Wagner, H., & Wieczerkowski, W. (1986). Teacher perceptions of highly gifted students in the United States and West Germany. *Gifted Child Quarterly, 30,* 55–60.

Chamberlin, S. A. (2002). Analysis of interest during and after model-eliciting activities: A comparison of gifted and general population students. *Dissertation Abstracts International, 64,* 2379.

Chamberlin, S. A. (2006). Gifted and talented teachers' and coordinators' perspectives of affect and mathematical problem solving in middle grade gifted programs in the United States. *Australasian Journal of Gifted Education, 15,* 32–38.

Chamberlin, S. A., & Moon, S. (2005). Model-eliciting activities: An introduction to gifted education. *Journal of Secondary Gifted Education, 17,* 37–47.

Chamberlin, S. A., & Moore, A. (2006). Cognizance of gifted education among elementary education professors in MCREL member states. *Roeper Review, 29,* 49–54.

Colangelo, N., Assouline, S. G., & Gross, M. U. M. (Eds.). (2004). *A nation deceived: How schools hold back America's brightest students* (Vol. 2). Iowa City: The University of Iowa, The Connie Belin & Jacqueline N. Blank International Center for Gifted Education and Talent Development.

Deizmann, C. M., & Watters, J. (2001). The collaboration of mathematically gifted students on challenging tasks. *Journal for the Education of the Gifted, 25,* 7–31.

Deizmann, C. M., & Watters, J. (2005). Catering for mathematically gifted elementary students: Learning from challenging tasks. In S. K. Johnsen & J. Kendrick (Eds.), *Math education for gifted students* (pp. 33–46). Waco, TX: Prufrock Press.

DeLacy, M. (2004). The No Child Law's biggest victims? An answer that may surprise. *Education Week, 23,* 40–42.

Feldhusen, J. F., & Huffman, L. (1988). Practicum experiences in an educational program for teachers of the gifted. *Journal for the Education of the Gifted, 12,* 34–45.

Feldhusen, J. F., & Kroll, M. D. (1991). Boredom or challenge for the academically talented in school. *Gifted Education International, 7,* 80–81.

Gavin, M. K., Casa, T. M., Adelson, J. L., Carroll, S. R., Sheffield, L. J., & Spinelli, A. M. (2007). Project M^3: Mentoring mathematical minds—A research-based curriculum for talented elementary students. *Journal of Advanced Academics, 18,* 566–585.

Hall, G., & Loucks, S. (1979). *Implementing innovations in schools: A concerns-based approach.* Austin: University of Texas, Research and Development Center for Teacher Education.

Hanninen, G. E. (1988). A study of teacher training in gifted education. *Roeper Review, 10,* 139–144.

Hiebert, J., Carpenter, T., Fennema, E., Fuson, K., Wearne, D., Murray, H., . . . Human, P. (1997). *Making sense: Teaching and learning mathematics with understanding.* Portsmouth, NH: Heinemann.

Joffe, W. S. (2001). Investigating the acquisition of pedagogical knowledge: Interviews with a beginning teacher of the gifted. *Roeper Review, 23,* 219–26.

Kaplan, S. (2003). Is there a gifted-child pedagogy? *Roeper Review, 25,* 165.

Krutetskii, V. (1976). *Psychology of mathematical abilities in schoolchildren* (J. Teller, Ed.; J. Kilpatrick & I. Wirszup, Trans.). Chicago, IL: The University of Chicago Press.

Llewellyn, D. (2002). *Inquire within: Implementing inquiry-based science standards.* Thousand Oaks, CA: Corwin Press.

McCoach, D. B., & Siegle, D. (2007). What predicts teachers' attitudes toward the gifted? *Gifted Child Quarterly, 51,* 246–255.

Moon, S. M., & Rosselli, H. C. (2000). Developing gifted programs. In K. A. Heller, F. J. Mönks, R. J. Sternberg, & R. F. Subotnik (Eds.), *International handbook of giftedness and talent* (pp. 499–521). Amsterdam, The Netherlands: Elsevier.

National Association for Gifted Children. (2005a). *What is gifted?* Retrieved from http://www.nagc.org/index.aspx?id=574&an

National Association for Gifted Children. (2005b). *NAGC-CEC teacher knowledge and skill standards for gifted and talented education*. Retrieved from http://www.nagc.org/uploadedFiles/Information_and_Resources/NCATE_standards/final%20standards%20(2006).pdf

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Neal, D., & Schnazenbach, D. W. (2007). *Left behind by design: Proficiency counts and test-based accountability.* Unpublished manuscript.

Reis, S. M. (2007). No child left bored. *School Administrator, 64,* 22–26.

Singh, D. K., & Stoloff, D. L. (2006, February). *What do teacher candidates have to say about their clinical experiences?* Paper presented at the meeting of the Association of Teacher Educators, Atlanta, GA.

Speirs Neumeister, K. L., Adams, C. M., & Pierce, R. L. (2007). Fourth-grade teachers' perceptions of giftedness: Implications for identifying and serving diverse gifted students. *Journal for the Education of the Gifted, 30,* 479–499.

Sriraman, B. (2003). Mathematical giftedness, problem solving, and the ability to formulate generalizations: The problem-solving experiences of four gifted students. *Journal of Secondary Gifted Education, 14,* 151–165.

Sriraman, B. (2005). Are giftedness and creativity synonymous in mathematics? *Journal of Secondary Gifted Education, 17,* 20–36.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Newbury Park, CA: Sage.

Tomlinson, C. A. (2002). Different learners, different lessons. *Instructor, 112,* 21, 24–26.

Tomlinson, C. A., Brighton, C., Hertberg, H., Callahan, C. M., Moon, T. R., Brimijoin, K., . . . Reynolds, T. (2003). Differentiating instruction in response to student readiness, interest, and learning profile in academically diverse classrooms: A review of the literature. *Journal for the Education of the Gifted, 27,* 119–145.

Tomlinson, C. A., Tomchin, E. M., & Callahan, C. M. (1994, April). *Preservice teachers' perceptions of and responses to the differential needs of gifted students in their classrooms.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

VanTassel-Baska, J., Quek, C., & Feng, A. X. (2007). The development and use of a structured teacher observation scale to assess differentiated best practice. *Roeper Review, 29,* 84–92.

VanTassel-Baska, J. (2003). Content-based curriculum for high ability learners: An introduction. In J. VanTassel-Baska & C. A. Little (Eds.), *Content-based curriculum for high-ability learners* (pp. 1–23). Waco, TX: Prufrock Press.

Westberg, K. L., Archambault, F. X., Dobyns, S. M., & Salvin, T. J. (1993). The classroom practices observation study. *Journal for the Education of the Gifted, 16,* 120–146.